PROJECT TITLE: Gladstone Water Treatment Plant - Demonstration Pilot Using Ionic Water Technologies, Inc., Rotating Cylinder Treatment System (RCTS), an Innovative Water Treatment Technology for Acid Mine Drainage

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PROJECT LOCATION: Gladstone, Colorado in Cement Creek, Animas River Watershed, San Juan County, Colorado, 8 miles north of Silverton, Approximate Latitude 37° 89' Approximate Longitude -107° 64'
WATERSHED NAME: Animas Watershed
POLLUTION TYPES: Acidity, Al, Cd, Cu, Fe, Mn, Zn; Cu and Zn are the primary mining-related contaminants of concern for Upper Cement Creek
Region 8 HIGH PRIORITY WATERSHED: Yes

Project Goals:

Goal 1: Improve water quality in the Animas Watershed by reducing metals and acidity arising from mine wastes and mine-impacted waters so that standards may be met at the downstream Animas River compliance point.

Goal 2: Demonstrate effectiveness of an innovative technology for treating mine waste sites at high altitudes under challenging conditions that is much less costly than traditional active treatment systems.

Goal 3: Contribute to ongoing regional goals for Brownfield's mine-scarred lands revitalization.

Regional History: The discovery of gold and silver brought miners to the Silverton /Animas River Watershed in the early 1870's. Between 1870 and 1890, the richer ore deposits were discovered and mined to the extent possible. Not until 1890 was any serious attempt made to mine and concentrate the larger low-grade ore bodies in the area. By 1900, there were 12 concentration mills in the valley sending products to the Kendrick and Gelder Smelter near the mouth of Cement Creek. Mining and milling slowed down circa 1905, and mines were consolidated into fewer and larger operations with the facilities for milling large volumes of ore. After 1907, mining and milling continued throughout the basin whenever prices were relatively favorable. By the 1970's only one year round producing mine (Sunnyside Mine) remained in the county. This mine ceased production in 1991, and has since undergone extensive reclamation efforts.

Approximately 1500 abandoned mine sites exist within the Animas watershed. These sites were mined before permits were required. Most sites are now owned by individuals not responsible for the mining disturbances; however, the Bureau of Land Management and the US Forest Service own over 85% of the land within San Juan County. The Animas River and many of its tributaries above Silverton carry high concentrations of metals from both mining and natural sources. The ASRG and its member entities have undertaken extensive sampling to characterize the water quality of the upper Animas

Sources:

- http://old.waterinfo.org/arsg/index.html
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Basin, and prioritize locations where treatment could result in better water quality. Since 1993, the ARSG has taken the lead in assembling and analyzing all physical, chemical, and biological watershed information. The ARSG crafted the extensive Animas Use Attainability Analysis, which was used to help the Colorado Water Quality Control Commission (WQCC) develop appropriate stream standards and TMDL's throughout the watershed. The adopted standards are based upon a combination of expected metal concentration reductions brought about by the remediation of 67 of the worse polluting mine sites and the biological potentials of the receiving streams.

Gladstone History: Gladstone is the site of an historic mining town that developed in the 1880s with the advent of mining in the surrounding area. The town declined in the 1920's, and today there are no remnants of the town. A few mills operated on the edges of the town; some tailings were deposited in the abandoned town site. The last operating mill in Gladstone closed in 1950's. Mining activities continued sporadically in the immediate Gladstone area until the early 1990s.

Gladstone has historically been the central location, and railroad terminus, for the milling and shipping of mine ores from this three square mile valley. In the 1960's the American tunnel was extended another mile out of Gladstone, beyond Gold King property, to access the Sunnyside Mine from below. The tunnel drained up to 1600 GPM from the mine. All ore from the American tunnel was transported out of Gladstone until the mines closure in 1991. Milling had already ceased in Gladstone before the 1960's and after that Sunnyside ore was transported to the Mayflower mill near Silverton. Sunnyside Gold Corporation (SGC) has removed all mine wastes and tailings that will be removed under their state mined land reclamation (MLR) permit.

The largest mine in the Animas Mining District was the Sunnyside Mine that closed in the 1990s and is now nearing completion of final reclamation. The four settling ponds associated with the Sunnyside Mine's water treatment plant were reclaimed in 2005 per a State of Colorado reclamation bond requirement. The Gold King Mine is currently in inactive status. Both these mines were partially accessed through the American tunnel that has its portal in Gladstone. Three bulkheads were placed in this tunnel to stop water discharges. The BLM owns the American Tunnel portal. There continues to be a small discharge (<100GPM compared to the peak discharge of 1,600 GPM) from the tunnel that is thought to be near surface groundwater.

Gladstone Current Status: Since 2005, regional Targeted Brownfield Assessment (TBA) work has involved assessment for pollution reduction of several mine drainages from patented mine claims and the ghost town of Gladstone via a modern, centralized water treatment facility in the vicinity of Gladstone. The Region 8 TBA also assessed the practicality of conveying and actively treating acidic mine drainage from several draining mines in the vicinity of Gladstone. Draining mines and easements for pipelines to transport drainage to the treatment plant may involve as many as 100 acres in less than a three square mile area.

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Numerous historic, now abandoned, mines exist within a two mile radius of Gladstone. A few of these mines have acid mine drainage flows between 30 and 300 GPM containing very high concentrations of acid and dissolved metals.

The former lime feed and settling pond type treatment facility was constructed in Gladstone in 1979 by Standard Metals Corporation. The facility served to treat water discharging from the American Tunnel, the main access into the Sunnyside Gold mine, as required by their water discharge permit. The facility operations and mine ownership was later transferred to the Sunnyside Gold Corporation. Under jurisdiction of a court consent decree to terminate their discharge permit, SGC installed several bulkheads within the Sunnyside Mine which has greatly reduced the amount of discharge out of the American tunnel. Seventy to 100 GPM continues to discharge presumably from near surface, "natural" ground water flows. All terms of the consent decree were met by SGC and in January of 2003 the treatment facility, operations, and permit were transferred to Gold King Corp., which owned much of the land intersected by the American tunnel. Gold King continued to operate the treatment facility, treating the remaining American tunnel discharge and adding the Gold King discharge, until September, 2004. Due to financial problems and the loss of the leased use of the property the settling ponds resides upon, Figure 1, Gold King terminated treatment of the discharge. The treatment plant is presently sitting idle for lack of funds to develop an adequate method to separate and dispose of the metal precipitates (sludge). Capitalization is needed for both a metal precipitation and concentration plant and continuous long term operation. Discharges and loads of copper, zinc, manganese, and other metals from the Gold King Mine and other mines in Cement Creek have increased since 2005. It has been determined that the BLM owns the American Tunnel portal. The former Gold King parcels are held by Salem Minerals Corp., a group that is a cooperative member of the ARSG and has indicated the desire to donate some land for siting a new water treatment plant.

Problems/Issues: Several sites including the American Tunnel, Gold King, Mogul, Grand Mogul, and Red and Bonita mines, are ranked as high priority, low volume/high metal concentration acid mine drainages that need to be considered for inclusion in a treatment facility. The existing but currently idle lime feed treatment plant treated only the American Tunnel, the Gold King discharge and, at times, upper Cement Creek.

Currently numerous mine claims in close proximity of Gladstone are property tax delinquent. Many individuals and some corporations have let their property go to tax sale so they don't have the liability associated with mine wastes and drainages. Current assessment values of the claims are minimal since they are assessed as vacant mine lands only (the lowest valuation category in the State). If discharges were treated the values could increase substantially as they would become desirable for residential and/or commercial/industrial development. All mine drainages considered for treatment are within one and one half miles of the new and expanding Silverton Mountain ski area. San Juan County considers the Cement Creek drainage and associated upland

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areas that are outside avalanche zones as part of their priority Redevelopment and Revitalization Corridor.

Due to the stoppage of water treatment, increased concentration of aluminum, cadmium, copper, manganese and zinc were observed in Cement Creek and downstream in the mainstem of the Animas River (TMDL compliance point A72) in the years 2005 and 2006.

Discharge from the American tunnel is now considered non-compliant and the former lime treatment plant is unlikely to be adequate for a modern and complete process. Gold King Corp. has no financial ability to operate the plant and the properties containing the lime feed plant and settling ponds have been foreclosed upon, subject to a redemption period.

Cement Creek, the receiving stream for the discharge of the American tunnel and other draining mines in the immediate area is unable to support aquatic life and only ambient water quality standards apply. Cement Creek is a major contributor of metals and acidity to the Animas River which has "goal-based" cold water aquatic life I standards. Presently 15 TMDL's are not being met in Cement Creek and the Animas River below Cement Creek's confluence. Cement Creek is the primary remaining target for metals and acidity reduction, necessary to bring the Animas River into Clean Water Act compliance.

Technology for active treatment plants has advanced in recent years. If newer technologies were employed improvement in cost efficiency of treatment and especially disposal of the American tunnel sludge could be realized. For instance, using the present lime feed system combined with a new smaller settling area, thickener, and filter press, a low volume solid brick of precipitates could be produced that could be disposed of in a more affordably way, such as in a landfill. The previous system hauled the sludge, containing 98% water, to an open tailings pond which is no longer available. An important objective of any water treatment system at Gladstone is for a plant that will maximize metal removal at minimal costs.

Due to the non-compliant status of the existing dormant treatment plant, various property owners, San Juan County, and Animas River Stakeholders Group (ARSG) participants are anxious to re-establish adequate treatment. The close proximity of the plant to other high impact draining mines and the necessity to meet downstream water quality standard goals provides a significant opportunity for a collaborative approach that could be enormously beneficial to the entire watershed, including aquatic resources, recreational users, fisherman, irrigators, and the municipal water users of Durango, CO and Aztec and Farmington, NM. A modernized treatment plant in the vicinity of Gladstone is likely to be the most cost efficient method of reducing metal and acidity loading to the Animas River watershed. The proposed demonstration project would determine the feasibility of the concept of potentially combining drainages of several mines for treatment

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plus possible treatment of upper Cement Creek, technologies to be used, preliminary plant design, land acquisitions (if any) required, and capitol and operating costs.

No CERCLA or RCRA response action has been taken on any of the sites.

Assurance of Future Redevelopment and Reuse of the Site – Brownfields/Mine-scarred Lands Revitalization Objectives

The site for the treatment plant needs to be determined. The plant will likely be located on private and/or public lands associated with a draining mine. Any and all mine drainages piped into the plant will benefit from treatment. Therefore land values on the patented mining claims will increase and property owners will be able to use the property for development purposes whereas presently the liability associated with mine drainage inhibits investment.

A mix of public and private ownership presently exists on the American tunnel treatment site. Adding additional drainages from surrounding mines adds more complexity. During the period of this TBA, the BLM and San Juan County have agreed to simultaneously complete an investigation on various legal aspects of ownership and future operation of the treatment facility. We anticipate a trust organization or a quasi-public entity such as a special improvement district will own and operate the facility. The legal investigation will make recommendations on this critical aspect of the project.

Environmental advocacy groups and downstream water users are aware of the problems faced with the treatment plant being inoperative and will insist that positive steps be taken to bring discharges into compliance.

Although most funding sources will need to be identified after the feasibility determination, it is anticipated that many entities will need to be involved. In 2005, the BLM requested $3 million for treatment plant development and operation. The BLM and San Juan County committed to accomplishing the legal assessment. The existing lime feed treatment facility, Figure 2, could be donated to the cause if we can act quick enough that it is not torn down as a requirement of the existing permit with DMG.

Benefits

1) Increased property valuations from decreased contamination and liability from draining mines on the project and adjacent lands.
2) Reduced metal and acid loading to Cement Creek and the Animas River. An active treatment plant may presently be the most cost effective method of treating high concentration, low volume acid mine drainage. The possibility of treating several mine drainages in one unit, plus perhaps waters from Cement Creek, would be a significant step in the effort to meet TMDL's and water quality standards.

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3) Significant health benefits would result from reduced metal concentrations for drinking water users in Durango, CO, and Aztec, Flora Vista, and Farmington, NM.
4) Development of a long term secured treatment facility would free other potentially available lands for commercial/residential development near the base of Silverton Mountain Ski Area. A substantial increase in winter recreational/tourist use would result.
5) Public lands would benefit from reduced metals pollution to area streams and wetlands. Aquatic life and aesthetic values would increase. Treatment of acid mine drainage would help restore the integrity, functions, and water quality of receiving streams and adjacent wetlands.
6) Cement Creek at Gladstone has been targeted by the San Juan Planning Commission as a development corridor. San Juan County and Silverton Mountain Ski area, which is adjacent Gladstone, are involved in trail development in the corridor as well. The County has little room elsewhere to grow as this valley bottom is one of the few locations in the county that are accessible by motorized vehicles. The County, ARSG, and Animas Conservancy are presently investigating potential conservation easements for on patented mine claims throughout the County and a newly formed Red Mountain Light Task Force has formed to put some private lands back into the public sector.
7) San Juan County is the poorest in the State and has the highest unemployment. This project will eventually provide local construction, operation, and maintenance opportunities.
8) Redevelopment could potentially include future mining activities as well. Mining redevelopment could lead to further abandoned mine land restoration and perhaps assistance with treatment plant operation.

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Partnerships:

PARTICIPANT LIST
of the
ANIMAS RIVER STAKEHOLDERS GROUP

Federal Entities

Bureau of Reclamation
Bureau of Land Management
U.S. Forest Service

U. S. Geological Survey
Army Corps of Engineers
U. S. Environmental Protection Agency

Colorado Agencies

Division of Wildlife
Division of Minerals and Geology
Colorado Department of Public Health and Environment
Colorado Riverwatch Program

Local Agencies

Southwestern Water Conservation District
San Juan Resource, Conservation and Development
Town of Silverton
City of Durango
San Juan County

Citizens Groups

San Juan Citizens Alliance
Western Colorado Alliance
River Watch Network, Inc.
Taxpayers for Animas River
Colorado River Alliance
San Juan County Historical Society

Private Entities

Gold King Mining Co.
Root and Norton Assayers
Silver Wing Co., Inc.
Howardsville Mill
Echo Bay Mining
Salem Minerals
Tusco, Inc.
Sunnyside Gold Corp.
Durango and Silverton Narrow Gauge Railroad
Mining Remedial Recovery Company
Alpine Environmental Service
Colorado Goldfields, Inc.

Plus numerous citizens from Silverton, Durango, and absentee property owners from throughout the nation

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Need: There are no discretionary funds within the Region 8 Brownfields/Site Assessment Unit (BFSA), the program that has been providing the multi-program "Face of EPA" support to the Animas River Stakeholders Group, Silverton, and San Juan County, Colorado. The BFSA program has been primarily representing the Superfund and Water programs since 2004. One of the Animas River Stakeholder Group and San Juan County objectives that the Region supports is improved water quality via an updated Gladstone water treatment plant. To date, the Region has used Targeted Brownfields Assessment funding to characterize individual sites' flows and loads, and the feasibility of an active high density sludge treatment process. At this time, a high density sludge process appears too costly for the ARSG and partners to implement. Therefore, in support of the ARSG, the Region would like to involve the expertise of the ORD-Engineering Technical Support Center for assistance on these mixed ownership sites where water treatment would have an impact on overall water quality improvement to the Animas River, and larger San Juan River Basin.

Possible Solution: Ionic Water Technologies, Inc. Rotating Cylinder Treatment System (RCTS)

ORD Role:

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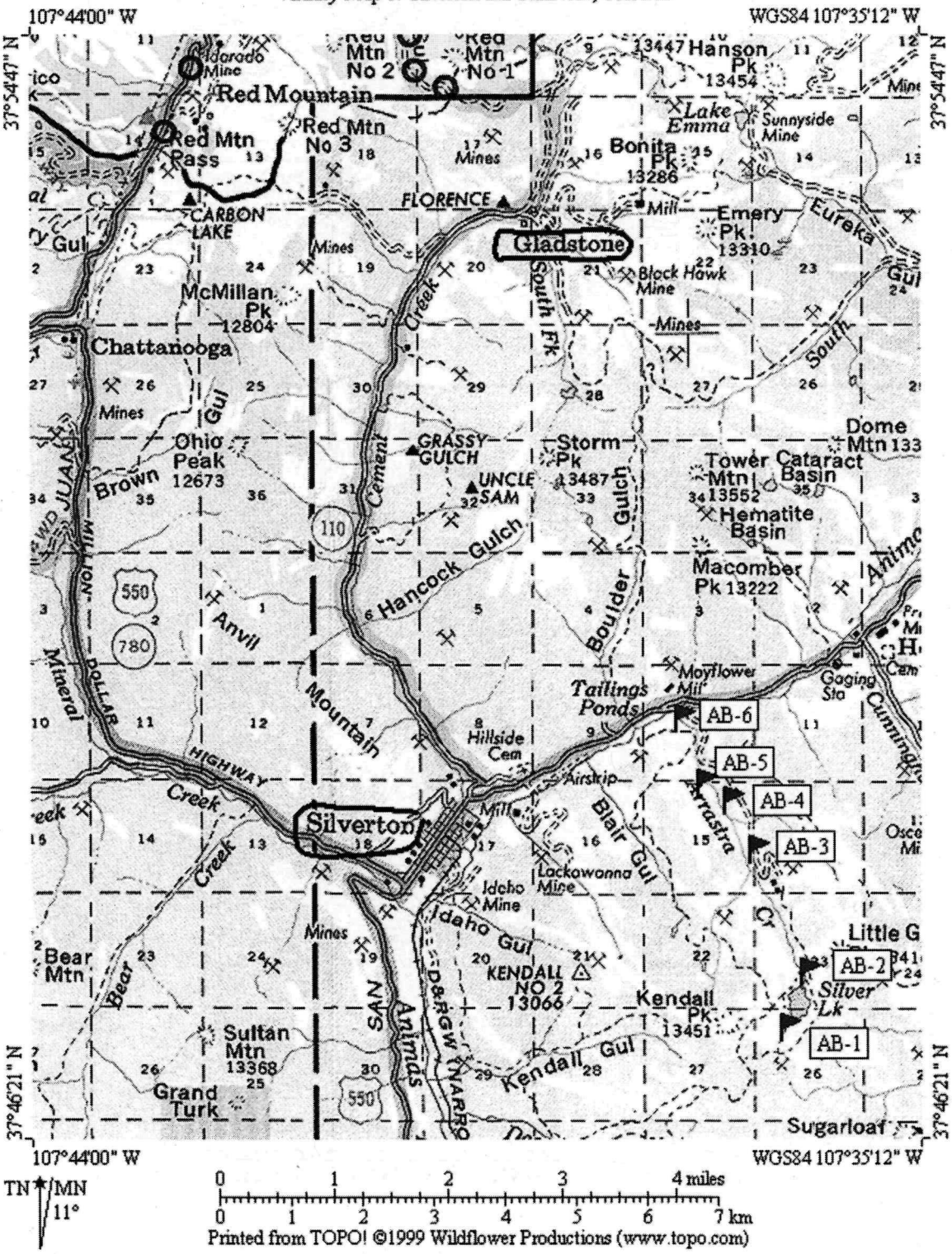
Vicinity Map 1: Silverton and Gladstone, Coloardo



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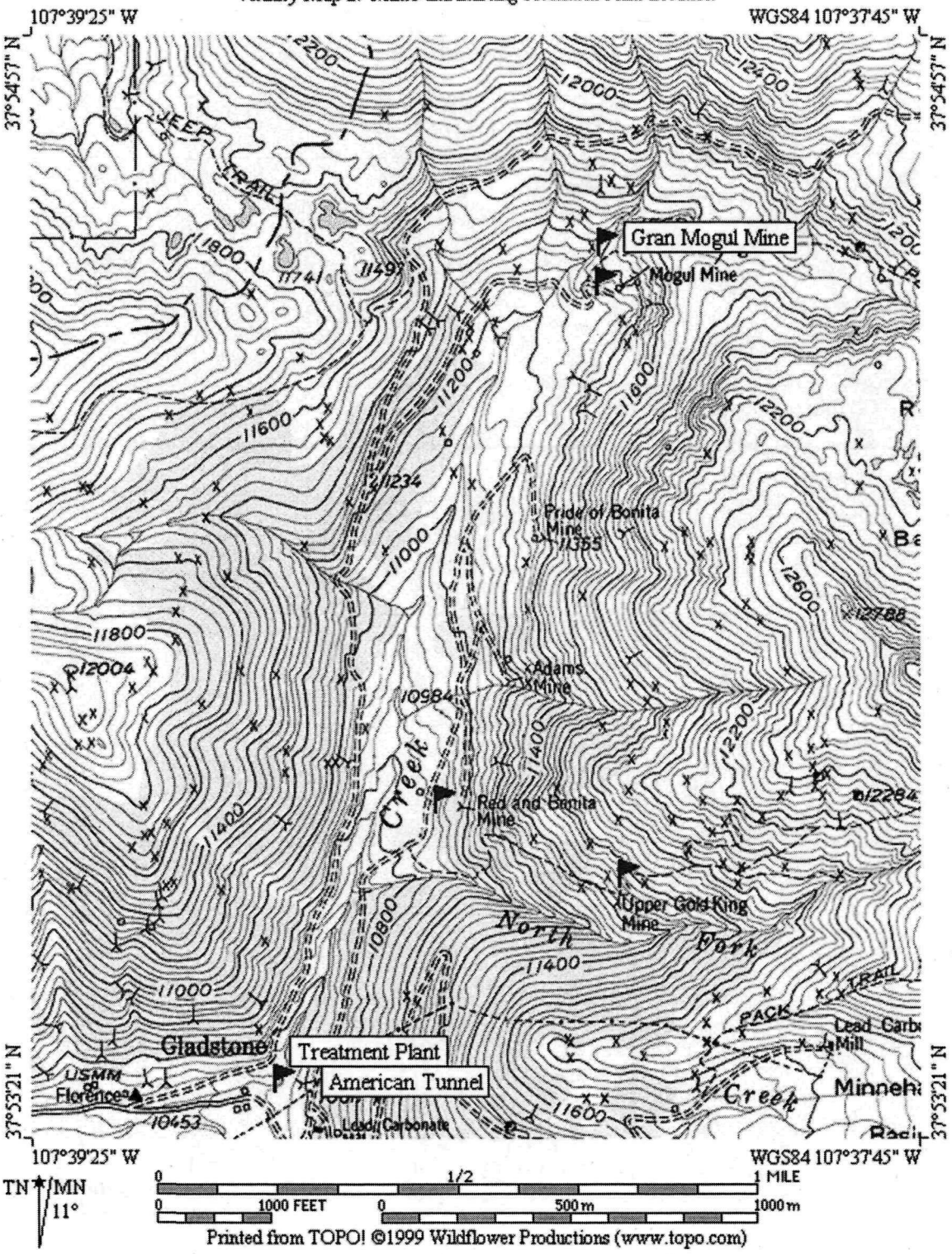
Vicinity Map 2: Mines and Existing Treatment Plant Location



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EPA Region 8 Proposal
For
ORD Mine-impacted Water Treatment
Demonstration Project Support

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